



## **INnovations in plant Varlety Testing in Europe**

### **Deliverable D2.4**

**Annotation of the dataset of DUS and VCU trial with low-cost sensors  
and standard reference measurements**

## Technical References

Project Acronym	INVITE
Project Title	INnovations in plant VarIety Testing in Europe
Project Coordinator	François Laurens
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Dissemination level <sup>1</sup>	CO
Work Package	WP2 - WP Setting up mobile high-throughput phenotyping tools to measure existing and new bioindicators
Task	T2.3 - Task 2.3: Supervised machine learning to upgrade trials in DUS and performance testing
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<sup>1</sup> PU = Public

PP = Restricted to other programme participants (including the Commission Services)

RE = Restricted to a group specified by the consortium (including the Commission Services)

CO = Confidential, only for members of the consortium (including the Commission Services)

## Document history

V	Date	Beneficiary	Author
1	02/07/2022	UA	Dr.David Rousseau
2	09/08/2022	INRAE	Dr.François Laurens
3	10/08/2022	UA	Dr.David Rousseau



## Summary

In this deliverable we deliver annotated version of some the data set provided in D2.3. They were then used to train the models delivered in D2.5



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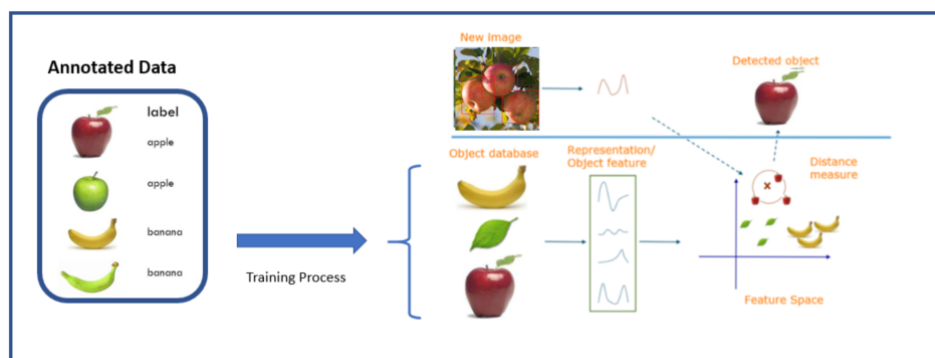
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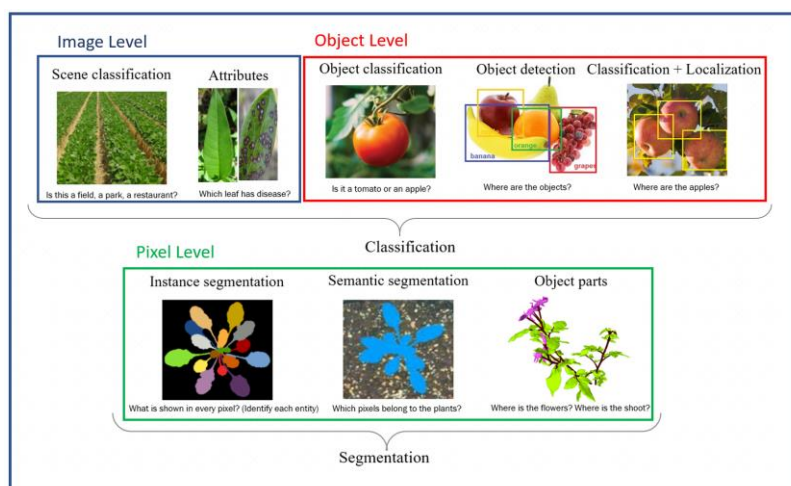
# 1.Introduction

WP2 develops mobile HT phenotyping tools to measure bioindicators related to better adaptation to more sustainable crop management practices, to variable climatic conditions and tools to evaluate DUS and VCU traits for which automation of the measurement procedure can lead to significant improvement of speed, precision, and efficiency. Task 2.1 identified the most promising traits to study and then, task 2.2 assessed the feasibility of replacing some current manual measurements with digital practices. Task 2.2 produced a large data set of images in order to implement machine-learning techniques and validation of the algorithms produced in task 2.3.

We operated with supervised machine learning as depicted in Fig. 1. In this models are trained on annotated images for which a human expertise is made explicit with labels attached to each image.



There are several types of annotation depending on the type of informational task attached to the image. Image level corresponds to classification (data 2.5 and Data 2.3) and a simple class or a scalar is attached to each images. The second level is the object level (data 2.1, 2.4, 2.5) and a bounding box around each object of interest is associated to the images. The last level is the pixel level (data 2.2 and 2.3) where each pixel is labelled.



## 2.Results

The provided links are updated links of the previous deliverables with annotated data added. We also add systematically the software or service which has been used for the annotation.

### 2.1 Apple detection on trees

**Date of acquisition:** 10/2019 and 10/2020.

**Location:** France(Angers), Spain, Switzerland, Belgium and Italy

**Image number:** 679 images

**Sensor description:** INSTA 360 one r

**Vector:** Camera mounted on a Stick, Camera mounted on a drone(dji mini 2)

3D Annotation has been performed with help of crowd sourcing on zooniverse with collaboration from the REFPOP group in INVITE : <https://www.zooniverse.org/>

**Link to DATA:**

<https://nextcloud.h2020-invite.eu/s/JT4dFpoiRMQMtrz>

### 2.2 Apple segmentation on sorting machine

**Date of acquisition:** 01/06/2021

**Location:** France (Angers)

**Image number:** 124 images

**Sensor description:** RGB camera(Canon 80 D)

**Vector:** The full description of the robot can be found in [1]

[1] Couasnet, Geoffroy, et al. "Machine learning meets distinctness in variety testing." *Proceedings of the IEEE/CVF International Conference on Computer Vision*. 2021.

Annotation has been performed manually with Ilastik software:

<https://www.ilastik.org/download.html>

**Link to DATA:**

<https://nextcloud.h2020-invite.eu/s/JT4dFpoiRMQMtrz>

### 2.3 Apple flowering



**Date of acquisition:** 04/2020 and 04/2021.

**Location:** France(Angers), Spain, Switzerland, Belgium and Italy.

**Image number:** 50 images.

**Sensor description:** RGB camera (minimal resolution required is 4000x3000) **Vector:** Manual

Annotation has been done with help of commercial services of Human in the loop company :  
<https://humansintheloop.org/>

**Link to DATA:**

<https://nextcloud.h2020-invite.eu/s/JT4dFpoiRMQMtrz>

## 2.4 Wheat height

**Date of acquisition :** 15 / 06/ 2021

**Location :** l'Anjouère, GEVES, France

**Image number :** 13 images RGB and 13 images Depth

**Sensor description :** Intel real sense d435

**Vector :** Camera mounted on a Stick

Annotation has been done during image acquisition by simply recording the images in adequate folders.

**Link to DATA:**

<https://nextcloud.h2020-invite.eu/f/19661>

## 2.5 Harvested tomatoes

**Date of acquisition:** June-October 2021

**Location :** Naktuinbouw, Roelofarendsveen

**Image number :** 1272

**Sensor description:** RealSense D415 and/or RealSense L515 **Vector:** Manual

Annotation has been done during image acquisition and with help of Nakt similarly to Data 2.4.

**Link to DATA:**

<https://uabox.univ-angers.fr/index.php/s/gVRSetS4tzRS2sv>

## 2.6 Number of plants after emergence in greenhouse



**Date of acquisition:** 13/02/2020 to 01/03/2020

**Location:** l'Anjouère, GEVES, France

**Image number:** 36 plants / 1398 RGB images and 1398 depth images for each plant **Sensor description :** Microsoft Kinect V2

**Vector :** Top view with a fixed vector

Annotation has been done with help of ImageJ

**Link to DATA:**

<https://nextcloud.h2020-invite.eu/f/19661>

### 3. Conclusion

These annotated data sets have then used to train machine learning models as described in detail in deliverable D2.5. While the annotation was done we also identified efficient tools for annotation which could be reused by partners to increase the number of images or address the variety testing traits.

